The Future of Online Apparel Shopping: Impact of Virtual Reality Try-on Features are Transforming Consumer Expectations in E-commerce and V-commerce

SHORT SYNOPSIS

Submitted in partial fulfilment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

to

Manav Rachna International Institute of Research and Studies

(Deemed to be University)

by

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22-23/Ph.D./W/046

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Certificate

I hereby declare that the Short Synopsis titled "The Future of Online Apparel Shopping: Impact of Virtual Reality Try-on Features are Transforming Consumer Expectations in E-commerce and V-commerce" being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in the Department of Commerce under School of Commerce of Manav Rachna International Institute of Research and Studies, Faridabad during the academic year 2024. It is a bona fide record of original work carried out under the supervision of Dr. Preeti Chhabra has not been submitted in full or part to any other university or institute for degree or diploma. Further, it is certified that Short Synopsis is plagiarism free and proof has been submitted.

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ABSTRACT

In today's digital landscape, Virtual Reality (VR) Try-on features play a pivotal role in shaping consumer perception and shopping experiences in online clothing platforms. E-commerce continues to evolve the integration of immersive technologies such as Augmented Reality (AR) and Virtual Reality (VR) has transformed the shopping experience, particularly in the apparel industry. It explores how these immersive technologies enhance consumer engagement by enabling realistic product visualization with the help of Virtual Reality (VR) Try-on features and 3D modeling, which allows consumers to visualize the product more interactively and engagingly. It highlights the benefit of VR in enhancing users' experiences which increases purchase intentions and fosters emotional connections with products, leading to increased customer loyalty and reduced return rates.

The objectives of this study are evaluating the impact of Virtual Reality Try-on features on consumer perception, assess overall shopping experience and satisfaction level between Virtual Reality and Traditional E-commerce platforms to explore potential future trends in online apparel shopping driven by advancements in VR technology and changing consumer expectations. It also discusses the challenges associated with implementing these technologies, which need advanced facilities and the varying levels of consumer acceptance across different demographics.

In this study quantitative research approach will be used utilizing both primary and secondary data collection methods. A Structures survey will be administered to gather numerical data on consumer perception, awareness and experiences. The sample will include diverse demographic groups to ensure comprehensive insights. Statistical analysis technique will be applied to quantify the relationships and trends which enable descriptive and explanatory analysis of the data. The systematic approach aims to provide robust findings that contribute to understanding the impact of Virtual Reality technology on consumer behavior in the Apparel industry.

KEYWORDS *Augmented Reality, Consumer Perception, Online Shopping, Try-on, Virtual Reality, 3D Visualization*

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1. DESCRIPTION OF BROAD AREA

In today's era, the Internet plays an important role in our lives. Today we buy everything online and the internet has a huge impact on the apparel industry. The way people use online platforms to buy apparel has changed. Nowadays, consumers use many online apparel sites to fulfill their needs. By 2022, the use of e-commerce will take India by storm. Every customer knows about this. Most people use their favourite online apparel stores. E-commerce continues to evolve with advancements in mobile shopping, social commerce, and omnichannel retail. Technologies such as augmented reality (AR) for virtual experiences and AI-based product recommendations are improving the online shopping experience. More than just convenience in today's digital world, online shopping is a way for fashionistas to express themselves and stay ahead of the ever-changing world of style.

Augmented Reality (AR) is increasingly being used in online apparel shopping day by day. It also enhances the customer experience by allowing consumers to see and visualize how the clothing articles will look on them before buying the outfit. This technology bridges the gap between physical store shopping and online shopping, which provides consumers with more interactive and immersive experiences.

1.1 MEANING OF AUGMENTED REALITY

Augmented Reality (AR) is a technology that overlays digital content and information such as images, videos, 3D models, or other relative data. Users can connect via smartphone or any other electronic device. Augmented reality integrates digital content with the real world in real-time, and users can see and interact with each other simultaneously. In the clothing industry, consumers access the retailer's AR-enabled Digital platforms through an app or a web browser, which requires a user's device camera.

1.2 VIRTUAL REALITY TRY-ON TECHNOLOGY

Augmented Reality (AR) is primarily applied in the form of Virtual Reality (VR) try-ons, with this retail brand letting customers virtually wear sample clothes, and accessories among many other types of personal effects. In this technology, the apparel industry offers more immersive and interactive shopping experiences. Augmented reality which overlays digital objects into the real world, virtual reality creates an entirely virtual environment that

simulates real-world environment shopping experiences. In the apparel industry, virtual reality try-on Feature allows users to visualize how garments will fit and look on their bodies without going to any physical stores and physically trying them. In today's digital age, several online apparel applications and websites using Virtual Reality try on features to give a pleasurable and engaging shopping experience. Like Zee kit (Acquired by Walmart), You Cam makeup (AR & VR features), H&M Virtual Try-on (via Snap AR), Gap's Virtual Dressing Room (Dressing Room App), Tommy Hilfiger VR Experience, Virtual Dressing Room by Zara, Supermodel by 3DLOOK, Burberry, Zalando Try on.

1.3 HOW CAN VIRTUAL REALITY TRY-ON FEATURE INCREASE CONSUMER LOYALTY?

VR try-on features significantly enhance Consumer loyalty in the clothing industry by creating a more engaging personalized and satisfying shopping experience.

Enhance Shopping Experiences: VR try-ons offer a unique and immersive shopping experience that can retain consumers by providing them with a more interactive way to try on clothes which makes shopping more enjoyable and memorable.

Personalization and Fit: VR try-on features allow users to create avatars that reflect their exact body dimensions. This helps users to see how clothes will fit them specifically, which leads to more accurate purchases.

Convenience and Efficiency: VR try-on features allow users to try multiple outfits quickly and conveniently from home or any other location which saves time as compared to traditional in-store shopping and helps to reduce returns due to fit issues.

Improved Customer Support: Some VR platforms offer virtual customer stylist facilities within the VR environment. This can provide additional help with outfit choice, style recommendation, and personalized outfit advice.

Exclusive Features and Rewards: Most of the Brands integrate VR Try-on features with loyalty programs, offering rewards or exclusive access to their new collection for users who engage with the VR experience.

Reduced Returns and Increased Satisfaction: By providing a more accurate representation of how clothes will fit and look, VR try-on features help to increase and make better purchase decisions which helps to reduce the number of returns.

Feedback and Improvements: VR try-on features can gather users' valuable feedback about fits, style, and overall experience. Which makes the brand more informative to continue to improve its services and offerings.

1.4 FACTORS INFLUENCE CONSUMER'S FUTURE ADOPTION OF VIRTUAL REALITY TRY-ON FEATURES

Technological Advancement: VR Technology has become more sophisticated and unique in today's world. The technology, clothing fit, accurate body measurement, fabric simulations, and high-definition graphics become a crucial part of customers' trust and satisfaction. Consumers can use this VR try-on features on multiple devices e.g. smartphones, laptops, tablets, and VR headsets will make the technology more accessible to a broader audience. This process is integrated smoothly into the online shopping experience. This also includes fast loading times, Minimum lag, and easy avatar creation.

Ease of use: If the VR try-on features are easy and simple to navigate, more consumers are likely to adopt them. Consumers expect fast and innovative solutions. This process requires minimal time for setup which boosts consumer willingness to adopt this Feature.

Privacy and Security concerns: Consumer may be concerned about the privacy of their data which saved their body data or personal information will be collected, used, or stored. Trust plays a critical role in adoption. If consumer trust the brand to handle their personal information responsibly, they will be more inclined to engage with the virtual reality try-on feature.

Social Influence and Trends: Consumers are often influenced by the behavior of others, who actively use social media platforms, seeing friends, influencers, and celebrities use VR try-on features helps them to adopt this new feature. Social validation and Sharing opportunities will encourage them to explore and adopt VR try-on features.

Perceived Enjoyment and Novelty: Using of VR try-on feature can increase consumers' willingness and attract younger consumers to try on clothes virtually. It feels more enjoyable and entertaining elements adding challenges and rewards, virtual fashion shows can make the VR experience more engaging and encourage users to purchase from the brands.

Demographic and Consumer Behavior: Consumers who regularly shop online may adopt VR try-ons more readily because they are familiar with the challenges of finding the perfect fit and size. Mostly Gen Z and millennials are more comfortable with adopting new technologies. These Generations are very familiar with the new technologies so the adoption rate is very high.

Convenience and Availability: In today's digital world this technology is available on many platforms which makes it more likely consumers will be to adopt them. They also have a wide range of products which is very convenient and easy to find the product which demand by the consumer.

1.5 BENEFITS OF USING VIRTUAL TRY-ON IN ONLINE SHOPPING

Improved for Accuracy and Confidence: The VR Try-on Feature allows the consumer to create personalized avatars as per their measurements and body fits. It enables them to see how clothes will fit in real situations. This reduces uncertainty about sizes and increases fit accuracy which leads to fewer returns and exchanges and also improves customer satisfaction and reduces operational costs for retailers.

Reduced Return rates: One of the major concerns in online shopping is the high return rate due to sizing and fit issues. VR try-on Reduced this by allowing to virtually Try-on before consumers buy leads to better fit and size purchases. Fewer returns also reduced shipping costs, less logistics burden, and lower inventory management expenses for retailers. It also helps to save time and money for both the consumer and retailers.

Enhanced Customer Experience: VR Try-on features are more immersive and interactive experience as compared to traditional online shopping. The gamification feature of adding virtual clothes can make shopping more fun. VR Try-on allows customers to create a unique shopping experience which can lead to higher customer satisfaction and loyalty.

Convenience and Efficiency: With VR Try-on Feature Consumers can try the clothes virtually from the comfort of their homes or any other part of the world without the need to visit physical stores. This is very useful for the individual or without easy access to physical retail outlets, Try-on allows customers to quickly visualize multiple outfits, colors, and styles without physically changing clothes. This makes the shopping process faster and more efficient.

Personalization and Customization: Consumer can personalize their avatars to match their actual body shape, skin tone, and even facial features. This customization helps them to visualize how clothing will look on them specifically. Some VR platforms allow users to customize the color, pattern, or style of the clothing in real time. Personalization boosts consumer satisfaction according to their needs and preferences which enhances their overall shopping experiences.

Reduce Uncertainty and Risk: VR Try-on reduces the uncertainty of how an item will look or feel, especially for items that are typically hard to visualize online with such a unique and complex design. With the help of the VR Try-on feature consumers can experiment with styles that may not normally try in-store shopping without any pressure or commitment.

Potential for Cross-Selling and upselling: VR Try-ons can stimulate how different items work together as a complete outfit. It also encourages consumers to purchase additional items like accessories or shoes to complete the look. It also offers styling advice or recommends complementary products, which leads to upselling the opportunities.

1.6 DRAWBACKS OF USING VIRTUAL REALITY TRY-ON IN ONLINE SHOPPING

High initial Investment: Developing and implementing VR Try-on features can be expensive for small business retailers. The cost includes hardware, software development, maintenance, and potential staff training are high in cost.

Technology Barriers: VR Technology requires modern smartphones, VR headsets, and other specific device. Consumers who do not have access to these devices are excluded from this experience. VR technology requires a high and fast-speed internet connection for seamless, real-time interaction. Where the internet is slower reducing the potential user for VR Try-ons.

Limited Realism and Accuracy: VR Try-ons aim to imitate real-life clothing fits, but current technology might not always provide a perfect representation of how clothes will fit, or drape on a consumer's actual body. Variations in fabric texture, weight, and movement may not be fully captured by this virtual environment.

Privacy and Security Concerns: The VR Try-on feature often requires users to input their body data, including measurements and 3D scans. Some consumers may feel uncomfortable sharing such sensitive personal information. With any online platform, the collection and storage of personal data could be susceptible to hacking or data breaches, which raise security concerns for the users.

Limited Product Range: In VR Try-on features the main issue in today's world is that not all the products are available for this, especially for small business retailers or brands that haven't digitized their full catalogue and product details. This technology may not apply as effectively other than fashion and accessories.

Maintenance and Updates: To ensure the VR Try-on experience is effective and seamless businesses must regularly update their platforms, including software updates, improvement to the 3D adding new collections, and fixing the bugs. Maintaining the technology to keep it functioning smoothly over some time can be costly for the business. It requires high cost which increases the burden for small business retailers.

Dependence on Consumer Technology Adoption: Not all consumers are comfortable or interested in adopting new technology. Older generations may prefer traditional online shopping rather than advanced online shopping experiences. VR is still an emerging technology it is not fully developed among all the products and categories. It is hard to trust this type of technology for the older generations.

1.7 TRADITIONAL E-COMMERCE VERSUS V-COMMERCE

Traditional E-commerce involves buying and selling products and services over the Internet using websites and mobile applications. Consumers visit online stores, browse product lists and catalogues, add items to their carts, and check out using a payment gateway.

V-commerce or virtual commerce involves using immersive and interactive technologies like, Virtual Reality (VR) and Augmented Reality (AR) to offer a more immersive and engaging experience. Consumers can explore virtual stores without going to any physical stores, interact with 3D representations of products, and stimulate a real-world shopping environment.

Here is the comparison of both technologies:

Dimensions	E-commerce	V-commerce
Definition	Through E-commerce, goods are bought and sold over the internet using websites and mobile applications	Through Virtual commerce, users are involved in interactive and immersive shopping experiences in a digital environment
Technology used	Mobile applications, website payments gateways	VR headsets, AR-enabled devices, 3D graphics, Latest smartphones and immersive platforms.
User Experience	Functional and Transactional with an emphasis on convenience, search and efficiency	Immersive interactive and experiential, designed to replicate or enhance physical in-store shopping
Product Presentation	Product pages with static images, text descriptions, videos and reviews	Interactive 3D models, Virtual Try-ons and virtual stores for real-time product interaction
Engagement Level	Relatively Low, as the process is catalogue-driven and non-interactive	High engagement, with interactive elements, personalized experiences and virtual shopping experiences
Accessibility	Accessible to anyone with an internet connection via	Requires advanced devices like VR headsets

	a computer, smartphone or tablet	or AR-enabled smartphones, making it less universally accessible.
Ease of Use	Simple interface with Familiar web navigation, filter and payment process	More complex, involving immersing technologies and requiring users to understand AR and VR navigation
Personalization	Basic recommendations based on user data, browsing or past purchases.	Advanced real-time customization and virtual previews, tailored to the user's preferences and requirements in the virtual space
Social Interaction	Limited to features like product reviews, ratings, or social sharing via links	Integrated social shopping experiences where users can shop with their friends or interact with virtual assistance in real time
Logistics and Delivery	Follow the traditional model of ordering online, then shipping to customers via Traditional delivery services	Similar logistics as E-commerce, but the immersive experience can enhance emotional connection, possibly reducing product returns.
Cost of Business	Lower cost of entry with minimal technology requirement, making it	High initial investment in VR /AR technology, 3D modeling, and

	accessible to a broad range of businesses	specialized software, limiting access to larger or technology forward companies
Customer Trust and Confidence	Relies on detailed product descriptions, reviews and return policies to build customer confidence	Greater trust through realistic 3D product interactions, virtual Try-ons, and immersive demonstration, reducing the uncertainty of online purchases.
Market Penetration	Well-established globally, with millions of businesses and consumers participating daily	Emerging with growing adoption in specific industries but not yet mainstream due to technological barriers.
Customer Relationship Management	Mostly handled through email marketing, loyalty programs and chatbots for customer services.	Enhanced CRM opportunities with virtual assistants, real-time interaction and personalized shopping experiences inside the virtual environment

Source: Self-created

2. LITERATURE REVIEW

Archana, P., N, Rakesh., & Bhojanna, U. (2024) Explores the role of augmented reality (AR) technologies in online retail, focusing on the apparel industry. It defines augmented reality and highlights its key applications, such as Virtual Try-ons and 3D Visualizations, which enhance consumer engagement by allowing users to visualize how the clothing will fit and look on them, additionally, the study indicates that augmented reality positively impacts consumer emotions, beliefs and purchase confidence, leading to improved customer loyalty and satisfaction. The methodology is primarily literature review-based, systematically analyzing existing research on augmented reality in online apparel shopping environments.

Branca, G., Marino, V., & Resciniti, R. (2024) Examines how products are evaluated and presented in a Virtual Reality (VR) environment, focusing on consumer behavior and the unique experiences and evaluations that emerge in virtual reality compared to traditional e-commerce. It highlights the multisensory nature of virtual reality experiences and their context-specific implications for product evaluation. The methodology employed is a systematic literature review conducted using Scopus and Web of Science collected and analysis of 31 peer-reviewed research article to identify key themes related to product evaluation in virtual reality.

Ibrahim, N.A., Chen, T.Y., Ahmad, N.H., Antara, P.M., Beta, M.D.M., Musa, R. (2024) Investigates the applications of augmented reality (AR) in retail, utilizing the Technology Acceptance Model (TAM) to explore user acceptance. It emphasizes perceived usefulness and ease of use as pivotal factors for augmented reality adoption, particularly within the fashion sector. Furthermore, the research identifies cultural and market dynamics in Malaysia that affect augmented reality acceptance. The study gathered data through surveys to assess consumer attitudes towards AR in Malaysia's local fashion with the findings validated through statistical analysis.

Kayadibi, S. (2024) explores the significant impact of consumer skepticism on attitudes toward augmented reality (AR) marketing, it provides immersive experiences, and skepticism, especially regarding privacy and usability which can hinder its effectiveness. The Technology Acceptance Model (TAM) and The Theory of Planned Behaviour (TPB) often fail to address this skepticism, which highlights a more comprehensive framework that incorporates the Stimulus-Organism-Response (SOR) model. The study employed a

quantitative research approach with a subject design involving 366 participants. Data were collected through online surveys and analyzed using Partial Least Square Structural Equation Modelling (PLS-SEM) with smart PLS-4.

Wang, J. (2024) Explores the integration of augmented reality and tactile feedback in online shopping, which highlights their potential to enhance user experiences.It reviews advancements in augmented technology within retail, showcasing successful case studies and the lack of tactile sensations. The study emphasizes that tactile feedback is crucial for enriching consumer interactions, improving product comprehension, and increasing purchase confidence. A mixed method approach was utilized, combining quantitative data from post-trial questionnaires with qualitative insights gathered from unstructured interviews and observations to evaluate the impact of tactile feedback in augmented reality environments.

Lavoye, V., Sipilä, J., Mero, J., Tarkiainen, A. (2023) Examines the impact of Virtual Try-on technology on enhancing consumer experiences within the fashion and beauty industries, emphasizing the importance of self-presence in creating realistic virtual reality experiences. By fostering self-explorative engagement, consumers are encouraged to actively participate and experiment with various styles. The study employed an online quasi-experiment involving 500 participants, using structural equation modelling to analyze how self-presence and self-explorative engagement influence brand cognitive processing and consumer attitudes.

Hilpert, L., & Zumstein, D. (2023) Examines the factors influencing the willingness to use AR in fashion E-commerce it also increases the importance of e-commerce, particularly in the Covid-19 pandemic which most consumers adapt VR technologies to give them VR Try-ons features and connect the consumer digital information to the real world. It also understands how AR can enhance the shopping experiences by providing interactive and immersive environments for consumers. A mixed research approach was used, combining qualitative expert interviewing and a quantitative user survey to analyze the willingness to use AR in the fashion industry E-commerce and developed statistical hypothesis testing.

Ricci, M., Evangelista, A., Roma,A.D., Fiorentino, M. (2023) Examines rapid growth of e-commerce and the integration of Virtual Reality (VR) technologies to enhance shopping experiences. It also indicates that immersive Virtual Reality (VR) improves user

engagement and purchase intentions compared to traditional methods. This study emphasizes the importance of user experience and cognitive load, while also noting the interdisciplinary nature of VR research. A within-subject experiment was conducted with 60 participants, comparing immersive Virtual Reality (VR) and Desktop Virtual Reality (DVR) shopping experiences using a Latin Square design to counterbalance treatment orders.

Oyelami, A. (2023) Examines the role of Augmented Reality (AR) in fashion retail and shows its potential to enhance consumer engagement and purchase intentions. It utilizes Innovation Diffusion Theory (IDT) to explore factors like relative advantage and trialability. Flow theory also emphasizes how immersive experiences can positively affect consumer attitudes. Existing empirical studies indicate AR enhances customer satisfaction and perceived value. A quantitative research method was used, utilizing a survey to collect data from 180 potential users of the "wanna Kicks" AR-enabled mobile app to analyze purchase intentions.

Voicu, M.C., Sîrghi, N., & Toth, D.M.M. (2023) Explores the role of Augmented Reality (AR) in e-commerce, to enhance the consumer experience and satisfaction. It also discusses the importance of optimizing online presence through AR technologies, particularly in Virtual Try-on applications, which allow consumers to visualize the product realistically. The main key theoretical frameworks including the Stimulus-Organism-Response (SOR) theory and the Technology Acceptance Model (TAM), are highlighted to explain consumer adoption factors such as technology attributes, utility, and social influences. A quantitative research approach was used, which utilized surveys to collect data from Romanian consumers regarding their experiences and satisfaction with augmented reality apps in online makeup shopping.

Aidanpää, B. (2023) Examines the evolution of Virtual Reality (VR) Technology and its application in retail, emphasizing its potential to enhance consumer engagement through immersive shopping experiences. It discusses consumer behavior theories, such as the UTAUT model, to understand technology adoption. It also highlights the growing importance of sustainability in fashion, noting that VR could reduce environmental impacts by minimizing physical store needs. A qualitative approach, conducting twelve semi-structured interviews, which were thematically analyzed to explore consumer perception of VR in fashion shopping and its sustainability aspects.

Quattelbaum, B., Breckenfelder, C., Voigt, J., Maas, L. (2022) Explores evolution of virtual and augmented reality (VR and AR) technologies, emphasizing their potential to enhance consumer shopping experiences through immersive interaction. It references the Stimulus-Organism-Reaction (SOR) model to explain consumer behavior in response to these technologies. While VR and AR can improve visualization and engagement barriers such as lack of haptic feedback and consumer skepticism hinder adoption. Generational difference in technology acceptance is noted with younger consumers more receptive. A qualitative approach was used, which utilized literature analysis to explore the impact of Virtual Reality and Augmented Reality on consumer behavior, decision-making process, and shopping experiences in the clothing industry.

Ronaldo, N., Wahab, E. (2022) provides the current situation of research on AR technology in E-commerce, it highlights its benefits, challenges, and theoretical frameworks that can help to understand customer adoption. It also discusses the phenomenon of web rooming behavior, where consumers research the product online before purchasing it in physical stores. The methodology employed quantitative research method data collected through surveys from 384 online Malaysian consumers to analyze key factors and future trends of Augmented Reality (AR) e-commerce adoption

Abbasi, K.M. (2022) Examines Augmented Reality (AR) as a transformative technology in online shopping and emphasizes its ability to enhance users' experience by allowing consumers to visualize products in a real-world context. The key factors that influence purchase intentions include interactivity, product tangibility, and perceived augmentation. It also identifies six critical attributes of AR- interactivity, information, enjoyment, novelty, vividness, and intrusiveness which impact consumer behavior. The multi-group analysis used two E-questionnaires to compare AR-assisted shopping and traditional web-based shopping, analyzing responses from 410 participants through a Structured Modelling Technique (SMT).

Morotti, E., Stacchio, L., Donatiello, L., Roccetti, M., Tarabelli, J., Marfia, G. (2022) Explores the growing significance of extended Reality (XR) technologies in enhancing consumer experiences in fashion retail. It references the Technology Acceptance Model (TAM) emphasizing the importance of perceived ease of use and usefulness in adopting VR and voice technologies that also note the unique characteristics of the fashion industry, where emotional connections and tactile experiences are vital. The study conducted a survey

involving 31 fashion experts to evaluate VR experiences, focusing on perceived comfort and usability while integrating voice interactions to assess their impact on shopping behavior.

Li CH., Chan OLK., Chow YT., Zhang X., Tong PS., Li SP., Ng HY., & Keung, KL. (2022) Examines Digital Content Marketing (DCM) as a strategy for engaging consumers and enhancing online purchase intention (OPI). It also highlights the role of Mixed Reality (MR) in creating immersive experiences that boost consumer engagement and trust. The main key factors influencing OPI, such as perceived value and brand trust, emphasize their mediating roles in the DCM-OPI relationship. The methodology employed Structured Equation Modelling (SEM) to analyze data from 374 online questionnaires, assessing the effectiveness of digital content marketing under a Mixed Reality training platform on online purchase intention.

Joglekar, P., Gohokar, V. (2022) Explores the evolution of technologies from basic image processing to advanced augmented reality (AR) applications. It discusses image segmentation a warping technique, distinguishing between marker-based and marker less AR approaches. User experience is emphasized, noting its impact on satisfaction and purchasing decisions. Challenges such as processing speed and accuracy are identified, alongside the need for high-quality input images. This study used a marketer-based augmented reality approach, utilizing image processing techniques like feature detection and matching along with OpenCV and Python to enable real-time virtual cloth try-ons.

MEIRINHOS, G., GONÇALVES, G., MELO, M., & BESSA, M. (2022) Explores the growing role of virtual reality (VR) in e-commerce emphasizing its ability to create immersive, multisensory experiences that enhance product understanding. It discusses product contextualization, which influences consumer attitudes by placing products in realistic scenarios. Gender differences in consumer behavior are noted, with existing research suggesting varying information processing styles, through the current study found no significant gender impact on purchase intention or satisfaction. It shows that VR application stimulates a refrigerator in two contexts (contextualization and neutral), with participants engaging in tasks while their purchase intentions and satisfaction were measured.

Park, H., Kim, S. (2022) Examines augmented reality (AR) and virtual reality (VR) in online retail to enhance consumer experiences by providing immersive, interactive environments. Research indicates that AR allows consumers to visualize products in a real-world context, while VR offers virtual store navigation. The main key factors that influence consumer responses include interactivity, product informativeness, and consumption vision, which affect the cognitive, affective, and behavioral dimensions of shopping. In this research a mixed method approach, combining qualitative content analysis of consumer experiences with AR/VR technologies and quantitative structural equation modeling to examine casual relationships among identified constructs.

Byram, A. (2021) highlights the increasing interest in consumer perception and adoption of online shopping technologies, especially in VR technology. It integrates frameworks such as the stimulus-organism-response theory and uses gratification theory to explain how external stimuli influence consumer behavior .it also calls for comprehensive models that incorporate diverse theoretical perspectives to better understand consumer interactions in a 3D virtual shopping environment. The study employed a conceptual model integrating the uses and Gratification Theory and Technology Acceptance Model, utilizing empirical data collected through questionnaires to analyse customer perception of 3D visual shopping.

Shen, B., Tan, W., Guo, J., Zhao, L., Peng Qin, P. (2021) Examines the intersection of consumer behavior and virtual commerce application design, highlighting the impact of immersive technologies like VR and VR on user engagement and purchase intention. it also calls for more empirical studies and a holistic approach to integrate insights from both fields, ultimately aiming to enhance user purchases in the metaverse. In this study systematic literature review methodology synthesizing research on consumer behavior and virtual commerce application design to identify influential factors, and design artifacts.

Adikari, S.B., Ganegoda, N.C., Meegama, R.G.N., &. Wanniarachchi, I.L (2021) Examines the evolution of virtual dressing rooms, starting from an early webcam-based system that lacked real-time features to utilize advanced in-depth sensors like Microsoft Kinect. It highlights successful platforms such as Kinect Shop and fit next, which offer realistic Virtual Try-on features. Existing systems face a lot of problems like inaccuracy of face measurement which require complex setup. The study employed a Microsoft Kinect V2 sensor for noncontact body parameter measurements and utilized the Unity 3D game engine to overlay 3D clothing models on users in real-time.

Syed, A.A., Gaol, F.L., Pradipto, Y.D., & Matsuo, T. (2021) Explores the transformative impact of AR and VR technologies which enhance product visualization, leading to increased customer satisfaction and purchase intentions. This also discusses the emotional engagement that arises from immersive experiences and the importance of user-friendly design to reduce issues like dizziness. In this study literature survey methodology was used, which reviewed existing research on augmented and virtual reality technologies in e-commerce to analyze their applications, impacts, and psychological implications for consumer behavior.

HWANGBO, H., KIM, E.H., LEE, S.H., & JANG, Y.J. (2020) Highlights the evolution of 3D virtual Try-on (VTO) technology. The main role of this technology is to enhance online shopping experiences by addressing consumer concerns about fit and style. It discusses the dual motivations of consumers -Hedonic and utilitarian, this shows how VTO provides both enjoyment and practical benefits. It also underscores the importance of qualitative insights into customer experiences and the need for integrating VTO into broader retail strategies to maximize its effectiveness in the competitive online market. This study used a mixed-methods-approach combining quantitative analysis of sales data from 8,058 customers using VTO with qualitative interviews to gather insights on consumer experiences and perceptions

Niu, M. (2020) Explores the evolution of virtual reality (VR) in retail, emphasizing its role in transforming the shopping experience, especially during the COVID-19 pandemic, which accelerated the shift of online fitting solutions. It discusses technological advancements like parametric modeling and Bezier surface generation essential for realistic garment fitting. User experience and engagement are critical, with studies showing that immersive interactions enhance consumer satisfaction. The methodology employed parametric drawing, Bezier surface generation, and 3D coordinate transformation to create realistic garment models, integrating users' body measurements to enhance virtual clothing fitting accuracy and personalization.

Mehta, J., Patel, P., Katira, H., Sahitya, A. (2020) Highlights the transformative role of Augmented Reality (AR) in enhancing retail experiences, particularly in virtual fitting rooms. AR improves consumer satisfaction by allowing virtual try-ons, which can reduce return rates and increase sales. However, challenges such as high implementation costs and the need for accurate user measurements persist. Variability in users' experience across demographics emphasizes the need for tailored solutions. In this study mixed method

approach was used, which combines qualitative user feedback and quantitative data analysis to evaluate the effectiveness of augmented reality applications in enhancing the shopping experience for clothing.

Wenzel, K. & Copeland, L. (2020) Examines the growing integration of augmented and virtual reality (AR/VR) in retail, enhancing consumer engagement and promoting social responsibility in the apparel industry. It emphasizes the need for consumer education on AR/VR applications and the significant concern among Generation Z regarding ethical consumption. Emotional engagement is crucial for influencing purchase intentions, as it fosters empathy towards social issues. The study utilized an online survey conducted via Qualtrics, featuring 32 questions to assess AR/VR use, perception, knowledge of fair trade, social responsibility concern, and purchase intention among participants.

Do, H.N., Shih, W., Ha, Q.A. (2020) Highlights the growing significance of mobile Augmented Reality (AR) applications in enhancing user experiences and influencing tourist impulse buying behavior. It discusses the integration of the Stimulus-Organism-Response (SOR) framework and the Technology Acceptance Model (TAM) to understand consumer interactions with Mobile AR. In this study the data collected through an online questionnaire which analyzed using Partial-Least-Squares-Structural Equation Modelling (PLS-SEM) to examine the effects of Mobile AR apps on tourist impulsive buying behavior

Zak, M. (2020) Explores the growing relevance of AR retail, particularly for enhancing online shopping experiences. It emphasizes existing research on consumer adoption factors but identifies a significant gap regarding the organizational perspective on AR implementation. The paper discusses relevant technology adoption theories, such as the Technology Acceptance Model (TAM), and calls for empirical studies focused on the challenges and success factors organizations face in adopting AR. In a nutshell, it sets the foundation for developing a conceptual framework to guide effective AR implementation in the clothing sector. In this study grounded theory approach was used which conducted qualitative interviews with 12 industry professionals to explore challenges and success factors in adopting Augmented Reality Try-ons in the online clothing sector.

Liu, Y., Xu, S., Cheng, K., Masuko, S., & Tanaka, J. (2020) Examines the impact of augmented reality (AR) and Virtual reality (VR) on online shopping. It also highlighted that AR provides more realistic garment visualization than VR due to its integration with real-

life scenes personalized avatars enhance user engagement, but the effect of personalized motion on purchase intention remains unexplored. In this study, two users' studies compare AR and VR-based try-ons against traditional e-commerce interfaces assessing personalized avatars and motions to evaluate their impact on the virtual try-on experience.

Jang, J.Y., Hur, H.J., & Choo, H.J. (2019) Highlights the significance of experiential shopping value and telepresence in influencing consumer behavior in virtual reality (VR) shopping environments. It indicates that a higher level of telepresence enhances consumers' approach intentions through perceived experiential value. Vividness and interactivity are identified as crucial technological dimensions. It also emphasizes the need for a sequential mediation model to understand how these factors interact and affect consumer responses. A quantitative approach was used which utilized a survey with 101 participants to assess the effect of vividness and interactivity on telepresence and experiential shopping value in a VR environment.

ALTARTEER, S., & CHARISSIS, V. (2019) Examines the Technology Acceptance Model (TAM) as a framework for understanding user acceptance of technology. Particularly in e-commerce. It emphasizes the importance of perceived ease of use and usefulness, alongside perceived presence in enhancing user experience in luxury retail. It establishes a theoretical foundation for this study highlighting the need for these themes in the context of luxury retail online stores and the adoption of VR technology. The study conducted a survey-based analysis using the Technology Acceptance Model (TAM) to assess users' attitudes toward a 3D virtual reality system, focusing on perceived ease of use, usefulness, and presence.

Chandra, S., Kumar, K.N. (2018) Examines the augmented reality (AR) technology's potential in e-commerce, which emphasizes its ability to enhance customer experiences. It also discusses established technology adoption theories, such as the Technology Acceptance Model (TAM) and the Diffusion of innovation (DOI) primarily focusing on consumer perspectives. This paper introduces the Technology-Organization-Environment (TOE) framework to explore organizational factors influencing AR adoption, including technological competence, top management support, and competitive pressure. A quantitative research method was used which utilized an online survey targeting high-ranking managers in e-commerce firms to gather data on factors influencing augmented reality adoption intention.

Kostadinova, M.D., & Embaye,N. (2018) Examines the role of Augmented Reality (AR) in enhancing the online shopping experience, particularly in fashion retail. It identifies key challenges faced by online retailers, such as inadequate size guides and insufficient product information, which contribute to high return rates. This also highlights the importance of consumer behavior and e-satisfaction in online purchasing decisions. It also discusses the potential for AR to provide a competitive advantage by improving customer engagement. A qualitative research method was used which utilized with customer service professionals from Swedish online fashion retailers to gather insights on challenges in product evaluation and the potential of augmented reality.

Jayamini,C., Sandamini, A., Pannala, T., Kumarasinghe, P., Perera, D., & Karunanayaka, K. (2017) Examines impact of Augmented Reality (AR) and Machine Learning (ML) in the fashion industry, focusing on enhancing design processes, enabling self-customization, and improving customer experiences. It highlights AR applications that allow designers to create virtual prototypes and consumer data to predict preferences and trends, which enhance AR effectiveness and satisfy consumer demand. In this study a comparative thematic analysis of existing research on Augmented Reality and Machine Learning in the fashion industry, focusing on their applications in design, customization, and customer experience enhancements.

Olshannikova, E., Ometov, A., Koucheryavy, Y., & Olsson, T. (2015) Explores the evolution of Big Data visualization techniques, highlighting their classification and inherent challenges, such as cognitive overload and oversimplification. It emphasizes the importance of human perception and cognitive psychology in designing effective visualizations. This paper also discusses the potential of Augmented Reality (AR) and Virtual Reality (VR) to enhance data interaction and understanding, addressing the limitations of traditional methods. Additionally, it explores Mixed Reality (MR) applications in visualizations. A researcher used a survey method that analyzed the existing literature on big data visualization techniques, human cognition, and the integration of VR technologies to identify challenges and propose innovative solutions.

Priyah, R., Vinod, V. (2014) Highlights the transformative role of augmented reality (AR) in online shopping, enhancing consumer engagement by allowing virtual try-ons and interactive experiences. It emphasizes the importance of user-friendly interfaces and secure transactions to build consumer trust. Technological advancement in computer vision and

graphics is crucial for effective AR applications. However, challenges such as varying consumer acceptance and the need for high-quality hardware remain. The researcher developed a prototype AR system for online shopping, utilizing real-time video processing and 3D modeling to create interactive product presentations that enhance user engagement and shopping experiences.

Shaikh, A.A., Shinde, P.S., Singh, S.R., Chandra, S., Khan, R.A. (2014) Examines the virtual dressing rooms which transformed e-commerce by enhancing user engagement and decision-making .it allows real-time visualization which improves purchase confidence and reduces return rates. However, many challenges hinder consumer satisfaction like registration problems and gesture recognition. The effectiveness of AR technology varies across demographic groups which necessitates tailored solutions. It creates virtual dressing rooms, utilizing real-time video feeds, motion tracking, and edge detection algorithms used on the user's body dimensions. This is typically done through photos that the user uploads.

Gabisch, J.A., Gwebu, K.L. (2011) Introduces the concept of channel congruence which refers to the alignment and consistency of brand experiences across different marketing channels which are: perceived diagnostic, self-image-congruence, and behavioral consistency .it suggests that this congruence can enhance consumer trust and influence purchase intentions. It also finds out the relationship between brand experiences and purchase intention, whether virtual or real it can lead to increased consumer willingness and confidence to purchase. The study conducted a survey method, collecting self-reported data from respondents about their Virtual reality experiences, attitudes, and purchase-intentions, through factor analysis.

Arakji, R.Y., Lang, K.R. (2008) Explores the emergence of virtual worlds and their economics, particularly through Massively Multiplayer Online Games (MMOGs). It highlights the potential of V-commerce for brand engagement and user interaction, emphasizing the diverse motivations driving user behavior. It identifies challenges in measuring business value and the need for new metrics tailored to the virtual environment. The Avatar Value Analysis, is a decision tree-based method incorporating traffic metrics to evaluate and manage business value creation in virtual commerce, particularly within in environment like Second Life.

3. RESEARCH GAP

To evaluate consumer awareness and understanding of virtual reality (VR) Try-on features in online clothing platforms which include a lack of comprehensive studies measuring awareness across diverse demographics, particularly among older consumers. Most existing research focuses on immediate purchase intentions without exploring the long-term effects of VR exposure on consumer behavior. There is a need to suggest a model that creates more awareness about the perceived drawbacks of VR Try-on features to service providers for their future reference. There are more areas such as the post-purchase experience of the consumer how they purchase the clothes in a virtual environment and how they look in a real manner.

4. PROBLEM STATEMENT

1. How do Virtual Reality (VR) try-on features influence consumers' purchase intention in comparison to Traditional E-commerce platforms?

2. How do trust and security perceptions impact consumer willingness to use Virtual Reality (VR) try-on features in online clothing shopping?

3. What factors are likely to influence the future adoption of Virtual Reality (VR) try-on features in online clothing shopping?

4. What concerns or drawback do consumers express regarding the use of Virtual Reality (VR) technology in the shopping process?

5. How do consumers rate their overall shopping experience when using Virtual Reality (VR) try -on features compared to traditional e-commerce platforms?

5. RESEARCH OBJECTIVES

1. To analyze how demographic factors (such as age, gender, and technological proficiency) affect consumer perception and acceptance of VR try-on features.

2. To investigate how Virtual Reality (VR) try-on features influence consumers' purchase intentions compared to traditional e-commerce platforms.

3. To assess the overall shopping experience and satisfaction levels of consumers using Virtual Reality (VR) try-on features versus those using Traditional e-commerce platforms.

4. To Explore potential future trends in online apparel shopping driven by advancements in virtual reality technology and changing consumer expectations

5. To evaluate the level of consumer awareness and understanding of virtual reality (VR) try-on features in online clothing platforms

6. RESEARCH METHODOLOGY

This refers to the systematic approach used to conduct research. The main parts included in this process are Research Design, Data collection, Sampling design, and Data analysis tools.

6.1 RESEARCH DESIGN

This research study is based on a quantitative approach that focuses on numerical data and statistical analysis to quantify relationships, trends, and patterns. It includes structured data collection methods such as surveys and statistical analysis techniques. descriptive and explanatory analysis will be used in this study.

6.2 DATA COLLECTION

Primary and secondary data-collecting methods will be used in this study. In primary data a questionnaire administered electronically using the internet (Through Google form) would be designed and used to collect information and desired outcomes and support the objectives. The main reason to collect data through an electronic survey due that the sample size of this research study is related to online shoppers who had experienced VR try-on

features in their shopping experiences and had purchased apparel. Whereas secondary data is obtained from existing resources such as books, periodicals, journals, government publications, newspapers, and google data base.

6.3 SAMPLING DESIGN

6.3.1 Sampling Technique: Non- Probability technique will be adopted. Convenience sampling is selected for this study. Non-probability sampling is based on non–random criteria to select samples according to personal subjective judgments. By using the convenience sampling technique researchers able to obtain the sample sizes quickly in the easiest way.

6.3.2 Sample Size: The target sample size consists of 500 online consumers.

6.3.3 Sampling unit: Respondents should be of both genders (Male and Female) of different age groups (Above 18 years), and income level. Who has made a purchase or has been buying apparel using VR Try-on Feature websites, applications, and online stores for the last 5 years.

6.3.4 Sampling Area: The data will be collected from Delhi/NCR Region. The questionnaires are randomly distributed throughout Delhi/NCR.

6.3.5. Data Analysis Tools: The collection of data would be followed by the data analysis and interpretation phase. The quantitative analysis would be used because it involves statistical techniques to analyze numerical data. Results will be given on generating further discussion and basis of outcomes and conclusions. As per the demand of data appropriate tools and analysis techniques (TAM model, T-Test, ANOVA, SPSS) will be used.

Research Objectives	Test and model will be used
To analyze how demographic factors (such as age, gender, and technological proficiency) affect consumer perceptions and acceptance of VR try-on features	**MANOVA, ANCOVA, SEM**
To investigate how VR try-on features influence consumers' purchase intentions compared to traditional e-commerce platforms.	**Sentiment and Behavioral Analysis, Mediation and Moderation Analysis**
To assess the overall shopping experience and satisfaction levels of consumers using VR try-on features versus those using Traditional e-commerce platforms	**Regression Analysis**
To Explore potential future trends in online apparel shopping driven by advancements in virtual reality technology and changing consumer expectations.	**TAM Model, PESTLE Analysis, Forecasting Analysis**
To evaluate the level of consumer awareness and understanding of virtual reality (VR) try-on features in online clothing platforms	**Regression Analysis. chi-square test**

7. EXPECTED OUTCOMES OF THE RESEARCH

7.1. Expected outcome of the Research from Consumer's Perspective

It aims to enhance consumer awareness about the leading higher purchase intentions and increased confidence in buying decisions due to immersive experiences. Consumers will enjoy more interactive and realistic shopping experiences, benefitting from improved fit accuracy and convenience while fostering trust in product representation. The study will also identify potential drawbacks, such as technological barriers and accessibility issues, and explore how demographic factors influence acceptance of VR technology. Furthermore, consumers will anticipate advancement in VR, providing valuable feedback on desired improvement, which may enhance brand loyalty towards innovative retailers.

7.2. Expected outcome of the Research from Marketer's Perspective

With the focus on increasing consumer engagement, the study anticipates that enhanced confidence in purchasing through VR will lead to higher conversion rates and reduced return rates. Additionally, the exploration of innovative VR experiences will offer brands opportunities to differentiate themselves in a competitive marketplace. Valuable consumer feedback gathered from the study will inform product and service improvement while identifying demographic segments that are more likely to adopt VR technology for tailored marketing approaches.

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